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MONONGAHELA RIVER BASIN AQUATIC BIOLOGY. PART I. FISH POPULATION STUDIES OF THE MONONGAHELA RIVER

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Environmental Protection Agency
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Monongahela River Basin
Aquatic Biology

Fish Population Studies of the Monongahela River

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Aquatic Biology

Part I: Fish Population Studies of the Monongahela River

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Region III, S&A Division
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Wheeling, West Virginia

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ABSTRACT

Fish population studies were conducted in the Monongahela River during the period 1967-1973. The results of these studies were evaluated in relation to trends in water quality. Comparative fish population statistics obtained from the upper Monongahela River shows zero fish in 1967 and 8,071 fish in 1973 at the same location. The same type of data obtained in the lower Monongahela River reveals a change of 20 fish in 1967 to 869 fish in 1973 at the same location. Intermediate data obtained in 1968, 1969 and in 1970 substantiates the gradual increase in the fishery resource. The data indicates significant improvement of water quality in the upper portions of the Monongahela River and less improvement in the lower portions of the river.

INTRODUCTION

Description of Monongahela River

The Monongahela River basin includes approximately 7,380 square miles in northern West Virginia, southwestern Pennsylvania and northwestern Maryland.

The Monongahela River is formed by the confluence of the West Fork and Tygart Valley Rivers at Fairmont, West Virginia. The river flows in a northerly direction for 128 miles and joins the Allegheny River at Pittsburgh to form the Ohio River. The Youghiogheny and Cheat Rivers are major tributaries of the Monongahela.

The Monongahela River basin is located in the Appalachian Plateaus province. The terrain is rugged and the valleys are deep and narrow. Flat areas are limited to narrow flood plains and some terraces and flat-topped hills. The elevations of the basin range from a high of approximately 4,600 feet above sea level in the headwaters of the Cheat River to about 700 feet at Pittsburgh.

Most of the agriculture, manufacturing, mining and urban and industrial centers are located in the western half of the basin with much of the basic steel industry in the basin located in the lower reach of the Monongahela River. Forested lands are more concentrated in the eastern half. Much coal mining has occurred in the basin, and coal extraction continues to be important in the general vicinity of the West Fork River and the main stem of the Monongahela River. Industries are concentrated along the West Fork and main stem Monongahela.

Most of the principal communities in the basin are a part of the Pittsburgh urban area. Other large communities are Clarksburg, Morgantown and Fairmont, West Virginia.

There are four existing reservoirs in the basin. These are Tygart Reservoir on the Tygart Valley River, Youghiogheny Reservoir on the Youghiogheny River, Lake Lynn on the Cheat River, and Deep Creek Reservoir in the Youghiogheny River basin.

The main stem Monongahela is navigable for commercial traffic throughout its 128 mile length. Eleven lock and dam structures are located on the Monongahela River for navigation regulation.

The Monongahela River basin has been severely polluted by drainage from coal mining activity. The main stem of the Monongahela River has been acidic, until very recently, throughout its length.

Historically, the Monongahela River once supported an abundant and valuable fishery resource. Lachner (1), in his general overview of the

changing fish fauna of the upper Ohio River basin, referred to an early investigation by Evermann and Bollman in 1886. These investigators recorded 40 species of fishes from the Monongahela River near the Pennsylvania-West Virginia border. Many pollution sensitive fishes such as the walleye and muskellunge were among the inhabitants of the river. During the first half of the 20th century, the intense mining in the watershed, the heavy industrial development in the lower river and the associated severe environmental degradation all but totally eliminated any species of fish from the Monongahela.

This void of fish life did not encourage fish population examination by appropriate agencies and hence, very little scientific data exists describing the fish life of the Monongahela in recent times.

The Ohio River Valley Sanitation Commission (ORSANCO) and the University of Louisville conducted fish resources studies of the Ohio River and some of the major tributaries during the period 1957 to 1959. Among the tributaries sampled was one station on the Monongahela River near Elizabeth, Pennsylvania, approximately 50 miles downstream of the West Virginia border. The results of this sampling produced only two small bluegill sunfish weighing 0.1 pound. The final report of this investigation, Aquatic Life Resources of the Ohio River (2) mentions the unusual "pale chartreuse" color of the Monongahela River and recorded a pH value of 3.8.

The Division of Water Supply, U. S. Public Health Service, one of EPA's predecessor agencies conducted water quality studies of the Monongahela in 1963. The biological examinations conducted during the study concluded that the combined effects of acidity and the deposition of sediments caused by mine drainage resulted in a drastic decrease in both the kinds and number of benthic macroinvertebrates (3).

The Federal Water Pollution Control Administration further documented the condition of the Monongahela basin during comprehensive investigations during 1965 and 1966. A synoptic benthic survey conducted as a part of this investigation reflected the severe impact of acid mine drainage on the Monongahela River basin (4).

Further studies by USEPA located and documented the major sources of acid mine drainage (5).

Long term monitoring of water quality as reflected by aquatic life has been conducted by EPA and its predecessor agencies since 1968. These monitoring studies consist of synoptic benthic biology surveys and collection of macroinvertebrates inhabitating artificial substrates placed in the major rivers and sampled periodically. The results of these studies are in Part II of this publication and document gradual improvement of water quality in the upper portion of the Monongahela basin.

In 1967, the FWPCA formulated fishery resource studies designed to establish conditions occurring in the river and provide a measure of water quality trends. The study was planned to be a comparison with the earlier 1957-59 ORSANCO-University of Louisville study. The study was implemented by the Wheeling Field Office and was conducted in cooperation with ORSANCO, the states of West Virginia and Pennsylvania and the U. S. Fish and Wildlife Service.

The study, proposed mainly for the Ohio River proper had the following objectives:

1. To measure the effect of pollution on a beneficial and legitimate use of interstate waters.

2. To provide an accumulation of baseline data to evaluate the effects of future changes in the pollutional loads carried in the waterways.

3. To evaluate the palatability of sport and commercial food fishes.

4. To compare the results of the 1957-59 ORSANCO-University of Louisville study with current data and evaluate the discernable difference in relation to water quality changes.

5. To evaluate the effectiveness of pollution control measures as related to the fishery resources.

Importance of Fishery Studies

The intent of this study was not solely to indicate the presence of pollution, but rather to reveal the effects of pollution upon a beneficial use.

Doudoroff and Warren (6) pointed out that fish, because of their beneficial uses, can be used as a direct measure of pollution.

Tebo (7) in describing the value of fish studies and pollution surveillance activities, stated:

"In this respect, fish are unique in that they are the only parameter measured by the Water Pollution Surveillance System which provide a direct measurement of the impact of changing pollutional loads on a beneficial use."

During the performance of a pollution survey in which the objective is to determine the presence or absence of pollution, it is usually

most efficient to examine sessile and sedentary forms of aquatic life.

It has been argued that fish, because of their mobility, are less desirable for pollution studies than other aquatic forms. An individual fish itself is mobile. A school of fish is mobile. A fish population consisting of incremental age (or size) groups of different species is not mobile. The presence of such an age and species distributed population is significant and can be related to water quality. If an imbalanced population structure exists and/or persists over a period of time, the causative environmental stress can be related to water quality.

The quality of the condition (condition coefficient) of fishes and the presence or absence of disease and parasitism are also indicative of environmental stress.

The imbalance of a fish population in its species composition can be related to known tolerance limits of a particular species. Doudoroff and Warren (6) point out that:

> "there is much more published information on the environmental requirements of fish than on the requirements of species of any other group of aquatic organisms excepting perhaps a few invertebrate species of outstanding economic importance."

Tarzwell and Gaufin (8), in discussing pollution surveys, state:

> "Data on fish population are especially valuable for indicating pollutional conditions because fish are the chief end product of the aquatic cycle. Data on the qualitative and quantitative composition of fish populations, rate of growth, average size, and catch per unit effort of sport and commercial fishery are especially valuable for denoting the suitability of water conditions and the economic and recreational losses due to pollution. In fact the suitability of a water for fish life is best defined by its productivity."

In specifically discussing fish studies related to pollution surveys, Tarzwell and Gaufin further state:

> "Although extensive areas of streams are often made fishless the effects of pollution are not always on an all-or-none basis. The complete absence of fish is usually common information, but deteriorations in the quality of the population is not generally apparent without some sampling studies. In polluted streams the game fishes may be reduced in number or

> eliminated while the coarse species are those most tolerant of low oxygen concentration comprise the remaining population. It has been the senior author's experience that when coarse fishes become abundant, they crowd out the game fishes which results in a marked decline in the sport fishery because the coarse fishes are not desired by the sportsmen and are inferior as food fishes."

The value of sampling fish populations in lock chambers and relating the results to water quality was aptly described in a study conducted by Krumholz and Minckley (9). After presentation of the data, the authors stated:

> "on the basis of these findings there is little doubt that the abatement of pollution in the upper Ohio River during the steel strike of 1959 provided a marked change in water quality that led to a reinvasion of the main channel of the river by fishes from nearby unpolluted waters. There was a marked resurgence in the fish population of the river, both in species composition and in numbers of individuals."

Without adequate data, these conclusions reached could not have been possible. The fact that sampling in lock chambers in the upper Ohio had been conducted in the previous years made the data comparable in describing the effects of pollution on the fish populations.

Methodology

Fish population studies are difficult to conduct in large, deep rivers. Several methods are available, such as nets, trawls, electrical shocking, and toxicants. All of these methods have certain advantages and disadvantages. Various seines and nets are decidedly selective for certain species and sizes of fish. Trawls have proven to be difficult to operate in river habitats. Electrical shocking is less selective but is only effective in shallow shoreline areas. Rotenone, a toxicant, is relatively non-selective and is effective in sampling deeper waters; however, certain requirements for the use of rotenone are necessary for the effectiveness of the toxicant. It is desirable to sample areas where the larger and open river fish forms are likely to be present. It is necessary to obtain an area small enough to concentrate the rotenone and in a closed system to prevent dilution of the rotenone concentration. Lock chambers meet these requirements.

The PHS Water Pollution Surveillance System (presently the Methods Development and Quality Assurance Research Laboratory, EPA) conducted a study pertaining to the examination and application of methods suitable for obtaining information on fish populations in large rivers

and recommended rotenone and electric shocking as the most feasible methods. The ORSANCO-University of Louisville Aquatic Life Project successfully sampled the lock chambers with rotenone in 1957-1959.

The basic mode of operation for this type of sampling begins with arranging with the U. S. Corps of Engineers a suitable time that will be convenient for the investigator and have a minimum of interference to river navigation. The sampling schedule has been normally arranged to be conducted in the early fall when fish populations would theoretically be the highest. The sampling time of the year was held consistent from year to year for comparison purposes.

On the sampling site, the study is conducted in the lock chamber at a downstream water level. The downstream lock gate is left open to the river for a period of at least two hours prior to the sampling. Once the sampling crew moves into the lock chamber with boats and gear, the lock gates and all discharge gates are closed. The fish toxicant is applied to the area and all affected fish are collected. This operation normally requires about 3 - 4 hours. After all fish are collected the chamber is filled to dilute the remaining toxicant.

The collected fish are identified, counted, measured (length and weight), and portions preserved for validation of identifications.

In 1967, the Wheeling Field Office, of the then Federal Water Pollution Control Administration, began fish sampling studies in the Monongahela River. The sampling locations selected were the Maxwell Locks and Dam, mile point 61.2 and Locks and Dam No. 2, mile point 11.2. The location of these sampling points is shown in Figure 1.

RESULTS AND DISCUSSION

The Monongahela River has two major industrial environmental stresses affecting water quality conditions. In the upper Monongahela, the primary environmental problem has been acid mine drainage and in the lower Monongahela it has been effluents from the steel and associated industries. The lower Monongahela River problem sources are concentrated in the first 40 river miles upstream from Pittsburgh. The two fish population sampling locations discussed here represent these two different environmentally affected areas. Maxwell Lock and Dam is typical of the upper river and Lock and Dam No. 2 represents the lower river. A summary of the results of the lock chamber studies conducted is shown in Table 1. The following discussions are presented in relation to the two sections of the river.

Upper Monongahela River

The results of the fish sampling at Maxwell Locks and Dam shows a sharp difference in number and weight collected exists between the 1968

Figure 1. Monongahela River Navigation Locks and Dams

Key: ★ Fish Sampling Locations

and 1969 sampling. Water quality monitoring records indicate that low pH values occurred less frequently in the late 1960's than in previous years. In 1970 the number of fish collected was reduced, but the total weight remained about the same. The species composition of the 1969 and 1970 was very similar, as a pollution tolerant species, brown bullhead, dominated the population. Tables 2 and 3 present the species composition of the Monongahela River samples.

The most dramatic change at Maxwell Lock occurred between the samples of 1970 and 1973. Not only did the number and weight of the fish population increase substantially, but the variety of species increased, thereby reflecting a significant and sustained improvement of water quality. Further, the 1973 species composition consists of an increase in pollution sensitive fishes, such as the largemouth bass, channel catfish and emerald shiners. The overall composition and the described increases in the fish populations at Maxwell Locks and Dam represents a significant reduction in the environmental stresses that had been operating for decades in the upper Monongahela River.

Specifically, at Maxwell Lock and Dam in 1967 no fish life was recovered in the 3 surface acre lock chamber. In 1968, one small bluegill sunfish was found in the sampling. In 1969, 204 fish weighing 6.5 pounds were taken in the sample. The species composition recovered were dominated by bullhead catfish and sunfish. In 1970, only 54 fish weighing 6.75 pounds were recovered and again, the population was dominated by bullheads and sunfish.

Fishery studies in the Monongahela River were not planned until 1975 by EPA. However, fisherman reports the fish and game agencies of West Virginia and Pennsylvania indicated a significant sport fishery and therefore, in order to document these changes, the States and the Wheeling Field Office, U. S. Environmental Protection Agency conducted sampling in September 1973. The results of this investigation at Maxwell Lock and Dam was astounding. A total of 8,071 fish weighing 91.5 pounds was collected and, more significantly, sixteen species were collected. Largemouth bass, a pollution sensitive species, made up 25.6 percent (by weight) of the total composition. The catch also include important forage fish and sport panfish.

Representatives of the Pennsylvania Fish Commission assisted in conducting these studies, and as a result of their evaluation of the results, recommended and implemented the stocking of sport fishes in upper Monongahela River in the State of Pennsylvania.

The Division of Fish and Wildlife, West Virginia Department of Natural Resources, has, in recent years, received numerous comments from local sport fishermen that substantial changes were occurring in their

catches. The Division wished to document these changes in the West Virginia portion of the Monongahela River and, in cooperation with U. S. EPA, Region III, conducted similar lock chamber studies in September, 1973 at the Opekiska Lock and Dam, mile point 115.4 and the Morgantown Lock and Dam, mile point 102.0. The results of the studies reflected a similar fish population to that collected at Maxwell Lock during the same month and year (10). Sixteen and fifteen species were collected respectively at Opekiska and Morgantown. The sunfishes predominated the composition at these two upstream stations. Since there has not been previous comparable studies conducted in the West Virginia portion of the Monongahela River, it is difficult to document recent changes or trends in the fish population. However, it has been assumed that because of the low pH and high acidity loads, there were few fishes inhabiting the river in previous years.

The state report also cites the pH changes observed during the decade 1962-1972 in which the 1962 average pH values for the Monongahela River was 4.7 and the 1972 average was 6.8 (WV Water Quality Network Data). The report concludes "The Monongahela River fishery, once dead, is now on the active list and coming back strong" (10).

The U. S. EPA and its predecessor agencies have also conducted other long term biological monitoring in the upper Monongahela since 1968. These studies have consisted of the periodic collection of aquatic macroinvertebrates on installed artificial substrates in the river. The data collected shows a steady increase in the number of taxa and individuals during the period 1968 through 1973. Also, there has been a corresponding increase in the frequency of occurrence that an increased diversity of aquatic forms appears. Such data supports the observation of an improvement in water quality. The results of these monitoring studies are described in detail in Part II of this report.

Lower Monongahela River

In the lower Monongahela River, the aquatic environment has not been impacted by acid mine drainage and/or its reduction as severely as the upper portion. Although some trends in the aquatic life can be observed, they are not as dramatic as those just described for the upper portion of the river.

Fish population studies have been conducted at Lock and Dam No. 2, mile point 11.2 in 1967, 1968, 1969, 1970 and 1973. The only previous comparable data for the lower Monongahela River is from the 1957 study at Elizabeth, Pennsylvania and mile point 24 by ORSANCO-University of Louisville team. The results of that study consisted of the collection of only two small bluegill sunfish weighing 0.1 lb..

The results of the 1967-1973 studies at Lock and Dam 2 are given in Tables 1 and 2. These results show an increase in the quantity of fishes in this area, but very little increase in the quality or the type of fishes. In 1967, 20 fish weighing 2.5 pounds were collected; in 1968, there were 207 fish weighing 28 pounds; in 1969, 1,626 fish weighing 58 pounds were collected and in 1970 only 261 fish weighing 45.7 pounds were in the sample. In 1973, a total of 869 fish weighing 75 pounds was collected. The species diversity increased from 4 to 15 during the period and, in the latter samples, pollution sensitive fish became more common. The trend at this location reflects an improvement, but not as great as occurred further upstream in the Maxwell area. The surface area of Lock and Dam No. 2 is .5 acre and approximately one third the size of the Maxwell Lock Chamber and therefore, on a per acre basis, a greater number of fish exist at Lock and Dam No. 2 than at Maxwell Lock. However, examination of the composition of the fish population reveals little improvement at Lock and Dam No. 2 during the study period in terms of a significant increase in pollution sensitive fishes. The predominant fishes in the samples were carp and bullheads. The lower Monongahela River fish population samples have remained relatively stable since 1969 and the 1973 data does not reveal significant changes or improvement. It appears that the population sampled at this location is one supported by migrants from the upper Ohio and lower Allegheny Rivers.

Similarly, the biological monitoring that has been conducted at Lock and Dam 2 since 1968, involving use of artificial substrates and examination of aquatic macroinvertebrate life, shows a gradual increase in numbers but predominated by a few forms. Essentially this indicates conditions remaining relatively constant with signs of improvement developing. The macroinvertebrate data of the Monongahela Basin study is presented in Part II of this report.

SUMMARY AND CONCLUSION

Associated with the observations on the fish population during the period of this study, there has been measurable improvement in the water quality as reflected by higher pH values and lower acidity loads.

A recent water quality assessment report (11) states that in the Monongahela River basin, most industries, including coal mining, have been making steady progress in reducing water pollution. In Pennsylvania, active mine discharges requiring treatment have been providing such treatment since 1970. Although not all are now in compliance in West Virginia, active mines with discharges requiring treatment are increasing the number of treatment facilities to meet compliance requirements. A recent EPA survey of active mine discharges stimulated the construction of several more facilities in West Virginia.

The fish population studies conducted on the Monongahela River have been used to monitor water quality trends. The studies reflect significant improvement of water quality in the upper Monongahela and less significant changes in the lower Monongahela.

In addition to providing measurements of water quality trends, basic fishery information can be easily related to the general public and the impact of the efforts of water pollution control agencies can be more fully realized.

TABLE 1

Summary of Fish Sampling, Monongahela River
1967 - 1973

	1967	1968	1969	1970	1973
Maxwell Lock (1.4 surface acres)					
Total number fish	0	1	204	54	8,071
Total weight fish (lbs.)	0	0.04	6.43	6.76	91.50
Number of species	0	1	8	6	16
Percentage sensitive species (by weight)	-	-	18	23	65
Lock No. 2 (.5 surface acres)					
Total number fish	20	207	1626	261	869
Total weight fish (lbs.)	2.58	27.33	58.33	45.70	74.48
Number of species	4	8	12	12	16
Percentage sensitive species (by weight)	26	9	6	12	31

Table 2 Composition of Fish Collections, Maxwell Lock
Monongahela River, 1967-73
(+indicates fraction of percent, X indicates hybrid)

Year	Species	Number	Weight	Percent by Weight
1967		0	0	
Total		0	0	
1968	Bluegill	1	0.04	100
Total		1	0.04	100
1969	Carp	1	2.20	34+
	Brown bullhead	108	3.05	47+
	Black crappie	18	.21	3+
	Pumpkinseed sunfish	69	.90	14
	Green sunfish	1	.01	+
	Orange spotted sunfish	1	.01	+
	Sunfish X Sand shiner	1	.01	+
Total		204	6.43	
1970	Golden redhorse	1	1.04	15+
	Brown bullhead	38	5.21	77+
	Bluegill	6	0.02	+
	Bluegill-Green sunfish X	1	0.03	+
	Pumpkinseed hybrid	7	0.43	6+
	Largemouth bass	1	0.03	+
Total		54	6.76	
1973	Carp	70	12.17	13+
	Goldfish	6	0.22	+
	Gizzard Shad	142	5.48	6
	Largemouth bass	265	23.42	25+
	Smallmouth bass	4	0.38	+
	Rock bass	1	0.06	+
	Pumpkinseed sunfish	9	0.49	+
	Green sunfish	2	0.15	+
	Bluegill	13	1.00	1+
	Green-Pumpkinseed X	1	0.16	+
	Sunfish, young of year unidentified	1,680	5.77	6+
	White crappie	6	0.47	+
	Channel catfish	88	11.06	12+
	Brown bullhead	270	20.08	21+
	White catfish	1	.05	+
	Emerald shiner	5458	10.49	11+
	Shiners (unidentified)	55	.05	+
Total		8,071	91.50	

Table 3 Composition of Fish Collections, Lock No. 2
Monongahela River, 1967-73
(+indicates fraction of percent, X indicates hybrid)

Date	Species	Number	Weight (lbs)	Percent by weight
1967	Bluegill	1	0.05	1+
"	Pumpkinseed sunfish	14	0.60	23+
"	Brown bullhead	4	1.92	74+
"	Shiner	1	0.01	+
Total		20	2.58	
1968	Gizzard shad	6	1.36	4+
"	Carp	45	13.16	47
"	Emerald shiner	69	0.60	+
"	Fathead minnow	1	0.01	+
"	Brown bullhead	69	12.27	43+
"	Bluegill	3	0.03	+
"	Green sunfish	13	0.42	1+
"	Largemouth bass	1	0.14	+
Total		207	27.99	
1969	Gizzard shad	17	2.05	3+
"	Carp	752	44.40	76+
"	Goldfish	1	0.04	+
"	Bluntnose minnow	1	0.01	+
"	Sand shiner	4	0.01	+
"	Emerald shiner	145	0.43	+
"	Channel catfish	1	0.20	+
"	Brown bullhead	522	10.30	17+
"	Pumpkinseed sunfish	173	0.66	1+
"	Bluegill-sunfish	1	0.01	+
"	Largemouth bass	4	0.21	+
"	Banded killifish	5	0.01	+
Total		1626	58.33	
1970	Gizzard shad	12	3.75	8+
"	Carp	98	31.70	69+
"	Bluntnose minnow	3	0.03	+
"	Emerald shiner	60	0.06	+
"	Mimic shiner	4	0.01	+
"	White sucker	1	0.10	+
"	Brown bullhead	73	8.36	18+
"	Channel catfish	2	0.04	+
"	Yellow bullhead	1	0.02	+
"	Bluegill	4	0.18	+
"	Orange spotted-sunfishX	2	0.08	+
"	Largemouth bass	1	1.37	3
Total		261	45.70	
1973	Carp	140	44.85	60+
"	Goldfish	1	0.80	1+

Table 3 Cont'd. Composition of Fish Collections, Lock No. 2
Monongahela River, 1967-73
(+indicates fraction of percent, X indicates hybrid)

Date	Species	Number	Weight (lbs)	Percent by weight
1973	Gizzard shad	271	20.81	27+
"	Channel catfish	39	0.64	+
"	Yellow bullhead	1	0.01	+
"	Brown bullhead	60	5.38	7+
"	Golden shiner	1	0.06	+
"	Mimic shiner)	47	0.10	+
"	Sand shiner)			
"	Spotfin shiner	15	0.06	+
"	Bluntnose minnow	6	0.03	+
"	Emerald shiner	237	1.30	1+
"	Rock bass	2	0.01	+
"	Pumpkinseed sunfish	18	0.17	+
"	Bluegill sunfish	30	0.23	+
"	Sunfish (unidentified)	1	0.03	+
Total		869	74.48	

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Scientific names of fishes listed in this report:

Gizzard shad, Dorosoma cepedianum (Lesueur)

Goldfish, Carassius auratus (Linnaeus)

Carp, Cyprinus carpio Linnaeus

Golden shiner, Notemigonus crysoleucas (Mitchill)

Emerald shiner, Notropis atherinoides Rafinesque

Spotfin shiner, Notropis spilopterus (Cope)

Sand shiner, Notropis stramineus (Cope)

Mimic shiner, Notropis volucellus (Cope)

Bluntnose minnow, Pimephales notatus (Rofinesque)

Fathead minnow, Pimephales promelas Rufinesque

White sucker, Catostomus commersoni (Lacepede)

Golden redhorse, Moxostoma erythrurum (Rafinesque)

White catfish, Ictalurus catus (Linnaeus)

Yellow bullhead, Ictalurus natalis (Lesueur)

Brown bullhead, Ictalurus nebulusus (Lesueur)

Channel catfish, Ictalurus punctatus (Rafinesque)

Banded killifish, Fundulus diaphanus (Lesueur)

Rock bass, Ambloplites rupestris (Rafinesque)

Green sunfish, Lepomis cyanellus Rafinesque

Pumpkinseed sunfish, Lepomis gibbosus (Linnaeus)

Orangespotted sunfish, Lepomis humilis (Girord)

Bluegill, Lepomis macrochirus Rafinesque

Smallmouth bass, Micropterus dolomieui Lacepede

Largemouth bass, Micropterus salmoides (Lacepede)

White crappie, Pomoxis annularis Rafinesque

Black crappie, Pomoxis nigromaculatus (Lesueur)